


AMSAT SATELLITE REPORT

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L5 Submarine Drowns ESA Recovery Prospects

After a devastating launch schedule slip caused by payload problems, ESA, the European Space Agency, suffered a further setback Friday when its fifth Ariane rocket launch developed a malfunction during the third stage burn. The ill-fated L5 vehicle plunged into the Atlantic at an undetermined point shortly after an apparent malfunction about 12 minutes into the flight. The third stage burn had but 2 minutes to completion when the anomaly was detected. Because of the location of the ground tracking stations and the flight path of the Ariane, some telemetry was apparently lost amounting to at least a minute or so during the critical interval when it is thought the problem which doomed the flight began to manifest itself.

Although the LO4 launcher was a complete success last December 20, the payload satellite, MARECS A developed the so-called "plasma sheath" problem which all but destroyed the usefulness of the satellite. Months of research into the problem and engineering to fix the problem caused a delay in the launcher schedule since several important ESA satellites had elements of their design in common with MARECS A. L5 left the pad at Kourou, French Guiana, Friday, 10 Sept. 82 just under 10 months after LO4, the last of the "test" launches. L5 was to be the first "operational" launch of Ariane.

The L5 mission lifted off the pad at precisely 02:12:03.330 UTC, 10 Sept. All seemed well for the first 12 minutes. The first stage burn, staging and second stage burn all apparently went well. About the time the tracking station at Natal, Brazil, expected loss of signal (LOS) from Ariane, the tracking station at Ascension Island expected acquisition of signal (AOS). When Ariane telemetry AOS on S-band (2203 MHz) did not occur on time it became apparent something had gone wrong. It was just about 12 minutes into the flight and about 2 minutes before scheduled 3rd stage burnout. At first it was thought that no telemetry at all had been received at Ascension. A while later it was found that about 180 seconds of telemetry *had* been received. It was determined that, whereas the planned trajectory would have taken L5 to a 16 degree elevation above Ascension's horizon, the actual elevation was a mere 1½ degrees. The autotracker simply didn't know where to look for the bird at first but locked on after a minute or so. The question remains to be answered as to what caused the devia-

tion from the planned course. The two main possibilities are an anomaly in the third stage engine or a problem with the guidance system.

The third stage engine is among the most advanced propulsion systems in existence. It was developed for Ariane and is a cryogenic engine. That is, it uses super-cooled, liquified gases as fuel and oxidizer. The HM-7 engine, manufactured by Air Liquide/SEP of France uses liquid oxygen and liquid hydrogen to produce 13,500 pounds of thrust for the 9400 kg (2100 lb.), 8.5 meter (28 feet) long third stage. The engine is thought to be rid of a series of defects which caused the stage to explode with alarming regularity during the R&D portion of the program. By contrast, the first stage is powered by the well-tested Viking 5 engines which are derived from the venerable French Diamont program. They have thousands of test hours on them and, despite the failure of a Viking injector nozzle design on LO2, Viking is generally thought to be a mature, stable design. The Ariane second stage is powered by a single Viking 4. Thus, one of the major question marks in Ariane has been the risky third stage. None of the prior 3 launches which progressed through to third stage ignition had problems with the HM-7 engine. (LO2, of course, blew up because of a first stage engine problem and thus the performance of LO2's HM-7 third stage engine was never evaluated!) Preliminary inquiry results may shed some light on the cause of the L5 failure. These results will likely be announced soon. Detailed study, such as that which followed the loss of LO-2, will consume months.

What will happen to the Ariane schedule now is anyone's guess. It is virtually certain that L6 and L7 will slip. L7, with ECS-1 and AMSAT's Phase IIIB satellites aboard had been scheduled for launch 3 Feb. 83. With the schedule now in turbulence again similar to that

FLASH

According to a well-placed ESA source, L5 succumbed to a faulty third stage hydrogen turbopump. F8ZS, operating from FY7KRU at Kourou, says a gear on the turbopump drive failed at 561 seconds into the flight causing the loss of thrust and dooming L5 with its payload. On the bright side, Jon believes the problem is specific to the individual pump and will not cause a major delay in subsequent launches. His guess for L7...about a month slip to March 83!

following LO2, it is impossible at this early date to determine what will happen when, according to AMSAT spokesmen.

L5 was the first launch to use the SYLDA or dual satellite launching system developed to maximize the Ariane's efficiency by allowing a single launcher to carry two medium sized satellites to geo-synchronous altitudes. Aboard L5 were MARECS B and Sirio 2. MARECS B is the second maritime European Communications Satellite. Since MARECS A has malfunctioned in orbit earlier this year with the plasma sheath problem, the loss of MARECS B sets a grievous precedent. Never before in the history of spaceflight have two geosynchronous satellites in the same system been lost (before operations commenced). The sponsors of MARECS have virtually nothing to show for their approximate \$250 million investment. Sirio 2 is the second Italian scientific satellite. The combined losses attributed to LO2 and L5 probably are half a billion dollars, bottom line!

The setback to ESA is incalculable. The race for launcher customers between ESA and NASA was heating to incandescent proportions. In the last year ESA's marketing arm, Arianespace, had thoroughly vanquished the U.S. shuttle launch marketeers. NASA points out that favorable financing terms arranged by a consortium of European banks backstopping Arianespace is the key to their inroads. The financing issue has become a festering, open wound since Arianespace has consistently lured lucrative U.S. customers like Western Union into the ESA fold. Now, however, many of the contingency plans laid by these customers may be exercised. Often a customer with a high priority payload will double book his launch requirements as insurance against the day when the launch queue gets jumbled (as it now apparently will be). Arianespace will be watching these customers closely and hoping to convince them to hold on until a fix, "just around the corner," can be implemented.

A Tale of Two Cities (or) How Wagon One Won

With irony suitable for a Dickens short story, a study in contrast emerged late last week with the launch of two rockets, Ariane and Conestoga. Ariane, the pride of the European Space Agency (ESA) undertook an ambitious step and fell short. Conestoga, seeking a profoundly more modest objective found the target. Both events occurred within a 12 hour period. Both involved the products of great cities. Paris, Headquarters of ESA (and in this case symbolic of the balance of the contributor nations of ESA) and Houston, famous for oil and football and now with a potential launch business, Space Services Inc., based there both sent forth their products. One made it and one didn't. ESA's Ariane, a French feminine name, scored naught when 12 minutes after launch it was radically off course. Conestoga 1, recalling the pioneer wagons of generations before, flew 362 miles downrange in a little over ten minutes and was scored a success. Score: Wagon one won, naughty lady lost!?!

This issue of ASR provides special coverage of the tragedy of Ariane and the joy in Houston.

Texas Style Rocketry Advances Space Commerce

Using a solid fuel rocket engine purchased from NASA, Space Services Incorporated launched its Conestoga 1 from a cow pasture on a remote island off the Texas coast last Thursday morning. The success of the modest mission marked the first step on the comeback trail for the small Houston company which last year (5 Aug. 81) blew up their initial attempt, a liquid fueled endeavor called Percheron.

The sleek white rocket, actually the second stage of a U.S. Minuteman missile purchased from NASA for \$360,000, carried a dummy payload of 150 liters (40 gallons) of water which it released just past the apogee of its powered flight, some 300 km (190 miles) high. Launch occurred at 10:17 Central daylight time (15:17 UTC) on Thursday, 9 Sept. 82. The launch had been delayed 24 hours because of a malfunction in the guidance system's gyro the day before.

Space Services, Inc. is a private concern financed by 57 private investors. They hope to sell low-cost launch services to companies and interests looking for highly specialized launch services. Oil companies have expressed interest because of the growing use of earth resources satellite imagery as a means of identifying geological formations and structures often associated with valuable, recoverable oil fields. These investors put up \$6 million to get the program going. According to Chairman David C. Hannah, Jr., another \$15 to \$20 million in venture capital is needed to bring the enterprise to the point where it can begin to show a profit. Hopefully that will occur in 1984. The price tag for placing a 225 kg (500 lb.) satellite in a 800 km (500 mile) high orbit will be between \$5 million and \$7 million.

Although AMSAT does not now have the cost of passage (at the million dollar level) on Conestoga, it has nevertheless laid the ground work for future cooperative efforts. On hand to observe the launch in Texas was Dr. Martin Sweeting, G3YJO, of the University of Surrey and AMSAT UK. Martin was to have flown to Washington, D.C. this past weekend (11-12 Sept.) to discuss his findings in Texas with AMSAT HQ staff. In particular, Jan King, W3GEY, who, with Dr. Karl Meinzer, DJ4ZC, are serving as consultants to Space Services, Inc. will be interested to know of Martin's findings. Martin, Jan, and Karl have in fact already initiated discussions on how AMSAT might avail itself of a "ride" in return for certain services it might provide to Space Services, Inc. AMSAT President, Dr. Tom Clark, W3IWI, has led the push to have a digital store-and-forward packet transponder aboard in a 1984 flight.

The 9 Sept. flight originated at Matagorda Island on the Gulf of Mexico. The site was a cow pasture belonging to one of the investors, Toddie Lee Wynne. Tragically and ironically the 85-year old Mr. Wynne, president of an oil company, collapsed and died of an apparent heart attack barely 5 hours prior to the launch on Thursday.

The Aerojet M56A-1 solid fuel rocket develops 43,000 lbs. of thrust, weighs 6350 kg (14,000 lbs.), is 1 meter (3 feet) in diameter and 9 meters (28 feet) long. It is manufactured for Space Vector Corporation of Nor-

thridge, CA and has been used by NASA and the military services for various versions of the Aries sounding rockets. As mentioned, it also comprises the second stage of the now obsolete Minuteman 1 ICBM.

The 640 second flight ended with impact as expected in the Gulf of Mexico. Aircraft and ships in the area had been alerted to stay clear as is the practice for launches of missiles and rockets.

Since the Percheron debacle 13 months ago, Space Services has reorganized and brought in much needed technical help including former astronaut Donald K. (Deke) Slayton who functioned as vice chairman and launch director. Another former NASA employee, Lee R. Scherer, former head of the Kennedy Space Center, is also on the management team. All together, however, Space Services employs only 7 full time. The German firm of Deutsche Forschungs und Versuchsanstalt fur Luft und Raumfahrt (D.F.V.L.R.) handled telemetry and tracking. The entire launch crew consisted of only 31 persons.

Space Services is seeking a launch site on the large island of Hawaii and is presently negotiating for one of two options there. The presence of the launch facility is not without opposition as locals see a risk to life and property with a rocket launch facility located on the island.

Annual Meeting Program Told

AMSAT President Tom Clark, W3IWI, has announced the agenda for the annual meeting and for the special Phase III seminar which precedes it.

The Annual Meeting will be held at the Employees Recreation Center, Goddard Space Flight Center, Greenbelt, Maryland on Sunday, 10 October, 1982. The events will begin in the morning with a tentatively planned swap-fest/flea market in the parking lot adjacent to the Recreation Center. The swap fest would be held from 9 to 10 AM. About noon a light picnic style lunch will be available comprising hot dogs, hamburgers, potato salad, beans and the like. Beverages including a keg of beer will be on hand. A \$5 donation to AMSAT includes the luncheon provisions.

About 2:00 PM the official meeting will commence. As usual, the President will report on the health of the organization as will the Treasurer and other key officials. The results of the election of AMSAT Directors will then be announced. It is planned that the meeting should adjourn by 3:30 PM so that those traveling from greater distances and having normal work days on Monday should be able to get an earlier start than had been the case in the past when, typically, the meeting did not break up until 10 or 11 PM.

On Saturday, 9 October, a special series of seminars will be held at the auditorium of the Johns Hopkins Applied Physics Laboratory near Laurel and Columbia, Maryland. According to W3XO who coordinated the availability of the APL facility, those coming in on I-95 should exit on route 32. Travel west on 32 to route 29 and then south on 29 1 mile to Johns Hopkins Road. Go right on Johns Hopkins Road and watch for signs.

Talk-in for both the Saturday and Sunday events will be on the AMSAT repeater on 146.835 (-600 split). The repeater now has excellent coverage and there should be

no problem accessing it from most locales in the Washington, D.C. vicinity.

The program for Saturday begins informally at 11:00 AM with free-form rag-chewing and other forms of verbal amusement. At 13:00 the forum will begin with the theme, "Phase III and You, 'What's It All About, Alfie'." Portions of the seminar will explain what's needed to work Phase IIIB with special emphasis on Mode L and how to get sufficient rf power at L band. Tracking the bird will be another major topic covered. Packet radio implication for Phase III and the AMICON concept will likewise be discussed. Final details and speakers remain to be determined but the list now includes W3IWI, WA2LQQ, KA9Q, W3GEY, W1HDX, and others.

At about 18:00 the seminar will end and those who desire may join an ad hoc group of over middle-aged delinquents in vandalizing a local bistro/pub/restaurant.

Those wondering how to get their respective acts together for Phase III will certainly want to attend this landmark seminar. Those wishing to maintain their dignity and avoid the local jail should avoid later events.

New NASA WX Satellite Book Spurs Interest

One of AMSAT's leading educators, Dr. Martin Davidoff, K2UBC, reports that NASA has put together a book that may have broad interest in the amateur radio satellite community. The book, "Teacher's Guide for Building Weather Satellite Ground Stations" is published by NASA's Office of Public Affairs. The authors of the new book are R.J. Summers and T. Gotwald. ASR believes the publication is free but is uncertain at this writing. The complete address to write to is:

Educational Programs Branch
Office of Public Affairs
NASA
Goddard Space Flight Center
Greenbelt, MD 20771

Be sure to include your own mailing address and the correct title of the publication in your inquiries to NASA. Tks K2UBC.

British Get Access to New Freqs

According to preliminary reports, the British amateurs will soon have access to new frequencies but will lose others. According to AMSAT Director and European Area Coordinator Pat Gowen, G3IOR, the 50 to 52 MHz band will be available under limited conditions. Low power, cw operations will be permitted at 18 and 24 MHz slots but the 431 and 432 MHz has been lost and that 10.25 to 10.4 GHz will be allocated on a shared basis within line-of-sight of London, England. Bill Tynan, W3XO, QST's "World Above 50 MHz" columnist checked with ARRL who in turn queried RSGB on the matter. The clarification from RSGB to ARRL to AMSAT is that the 50-52 MHz permits will be limited to 40 special licenses and that operations will be constrained to non-TV hours. More details as they become available.

New Vermont Station Brightens W.A.S. Chances

WA1ZMS is on the OSCARs now and his Rutland, Vermont station should gladden the hearts of those needing the rare New England state. Brian Justin, WA1ZMS, says that although he is at present "rockbound" with a single 145.883 MHz uplink frequency, he is happy to sked anyone who needs Vermont and is patient enough to obtain a QSO in spite of Brian's modest station. Brian indicates that his 2 meter rig comprises a converted FM rig which he keys for cw. He is at present without a 10 meter

preamp for his receiver. He hopes to obtain a crystal soon that will permit operation on the RS birds. Anyone who can help this ambitious and talented high school senior who recently earned his Extra ticket should contact Brian at his Callbook address: Brian D. Justin, WA1ZMS, Old East Proctor Road, Rutland, VT 05736. His current needs are some new "rocks" and a 10 meter preamp. Any offers? Any skeds?

AMSAT Satellite Report Orbital Data

Reference Orbits

Satellite Designation	Date Time of Ref Orbit	Long. (Deg)	Period (Min)	Incr. (Deg)	Time Offset (Seconds)	Long. Offset (Degrees)
AO-7 (74-089B; 07530)	12 Sep 01:36:42	115	114.9395	28.74	(Not listed)	
AO-8 (78-26B; 10703)	12 Sep 01:46:43	101	103.1725	25.79	+ 221	+ 1.1
UO-9 (81-100B; 12888)	12 Sep 00:39:05	144	94.988	23.75	(Not listed)	
RS-3 (81-120A; 12997)	12 Sep 00:02:22	221	118.5183	29.76	+ 43	*
RS-4 (81-120D; 13000)	12 Sep 01:53:58	246	119.3943	29.98	- 7	*
RS-5 (81-120C; 12999)	12 Sep 00:35:34	226	119.5555	30.02	- 79	*
RS-6 (81-120F; 13002)	12 Sep 00:55:21	234	118.7167	29.81	- 29	*
RS-7 (81-120E; 13001)	12 Sep 01:06:47	235	119.1958	29.93	+ 25	*
RS-8 (81-120B; 12998)	12 Sep 01:55:17	246	119.7648	30.07	+ 26	*

Offset from the *Project OSCAR Calendar* as of 12 Sept. 82. A plus sign indicates add to Calendar prediction, minus means subtract. An "*" indicates less than 1 degree.

Keplerian Elements

	RS-3	RS-4	RS-5	RS-6	RS-7	RS-8
Element Set #	35	51	43	30	54	122
Ref. Epoch	82 249.15797890	82 249.68981516	82 249.12994276	82 248.03084208	82 248.09326315	82 248.75916918
1st Der. Mean Mot.	-0.00000034	-0.00000029	0.00000019	-0.00000005	0.00000008	0.00000201
Inclination	82.9611	82.9644	82.9605	82.9613	82.9601	82.9616
RAAN	133.5321	135.7842	136.5018	134.7280	136.0166	137.2302
Eccentricity	0.0058016	0.0018240	0.0011002	0.0049673	0.0022183	0.0020414
Arg. of Perigee	269.8385	331.4345	7.7497	285.8354	299.0519	40.5910
Mean Anomaly	89.6032	28.5687	352.3731	73.7239	60.8347	319.6642
Mean Motion	12.15573132	12.06656218	12.05029118	12.13547981	12.08665180	12.02926958
Rev. # of Ref. Epoch	3192	3175	3164	3173	3161	3154

	AO-8	UO-9	AO-7
Element Set #	686	272	470
Ref. Epoch	82 244.54213125	82 250.08031633	82 250.43764908
1st Der. Mean Mot.	0.00000119	0.00008977	0.00000009
Inclination	98.7780	97.5018	101.3990
RAAN	265.9017	211.8637	255.6530
Eccentricity	0.0007973	0.0002190	0.0012204
Arg. of Perigee	47.7583	186.3622	73.6333
Mean Anomaly	312.4155	173.7774	268.6089
Mean Motion	13.964814192	15.17043793	12.53376579
Rev. # of Ref. Epoch	22895	5079	35740